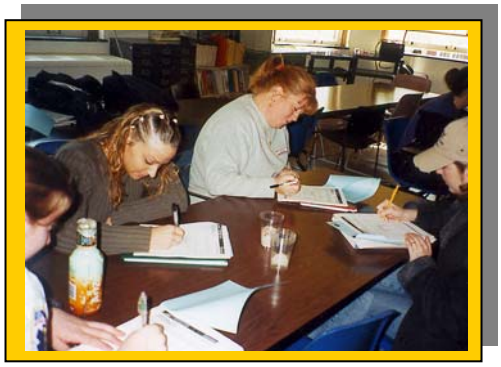
Data Analysis and Generalizations

Revising an Investigation

TEACHER GUIDE

BACKGROUND INFORMATION



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Public discussions of explanations proposed by students is a form of peer review of investigations, which is an important aspect of science. Talking with peers about science experiences helps students develop meaning and understanding. The *National Science Education Standards* (NSES) call for students to "formulate and revise scientific explanations and models using logic and evidence. Student inquiries should culminate in formulating an explanation or model. Models should be physical, conceptual, and mathematical. In the process of answering questions, students should engage in discussions and arguments that result in the revision of their explanations. These discussions should be based on scientific knowledge, the use of logic, and evidence from their investigation."

The NSES 9-12 inquiry standards go on to state that, "Their conversations clarify the concepts and processes of science, helping students make sense of the content of science. Teachers of science should engage students in conversations that focus on questions, such as 'How do we know?' 'How certain are you of those results?' 'Is there a better way to do the investigation?' 'If you had to explain this to someone who knew nothing about the project, how would you do it?' 'Is there an alternative scientific explanation for the one we proposed?' 'Should we do the investigation over?' 'Do we need more evidence?' 'What are our sources of experimental error?' 'How do you account for an explanation that is different from ours?'"

In this activity, students refine their investigations by having their methodology, procedures, and data analysis reviewed in a peer-review process. In this way students will have the opportunity to see the work of others in light of what they have already done. This gives students a chance to evaluate draft reports from peers using a rubric. One part of the peer-review process is the chance for students to discuss the evaluations with the reviewers. In this way, suggestions and arguments can be made clear for each study. Students then have the opportunity to make revisions or alter their explanations and generalizations based on peer feedback.

Using a rubric, students will then prepare to present their findings to the class as a poster session at a "state of the solar system conference." Each student will develop a one-page abstract that summarizes the process and findings. The poster will illustrate the question, methodology, and data (including anomalies) in the forms of charts, illustrations, and graphs in order to show relationships. During the poster session, the students will communicate the process used, report any revisions made as a result of the peer review, and the generalizations resulting from their findings. During the poster session the class will make recommendations and collaborate with the instructor to assess the student work using the same rubric that was used during preparation.

NATIONAL SCIENCE STANDARDS ADDRESSED

(Source – *National Science Education Standards*)

Grades 9-12

Science As Inquiry

- Abilities necessary to do scientific inquiry
- Understandings about scientific inquiry

History and Nature of Science

- Science as a human endeavor
- Nature of scientific knowledge

(View a full text of the National Science Education Standards.)

PRINCIPLES AND STANDARDS FOR SCHOOL MATHEMATICS

(Source – *Principles and Standards for School Mathematics*)

Grades 9-12

Data Analysis and Probability

Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them
Select and use appropriate statistical methods to analyze data
Develop and evaluate inferences and predictions that are based on data
Understand and apply basic concepts of probability

(View a full text of the Principles and Standards for School Mathematics.)

MATERIALS

For each group of three to four students:

- Student Text, "Peer Review "
- Student Activity, "Peer Review"
- Student Activity, "Poster Session Rubric"
- Student investigation reports from the "Development" section

PROCEDURE

1. Ask students to think about some of the benefits of reviewing a peer's work. Encourage students to think about this from both the writer's point of view and the reviewer's point of view. List student responses on the board.

2. Distribute the Student Text, "Peer Review," to each student. The first two paragraphs include some of the benefits of conducting a peer review that may have been mentioned during your opening discussion. Ask students to read the text and ask any questions about the proposed peer-review process. Explain to students that they will be conducting peer reviews of each other's work using a process similar to what is described in the text.

Alternate Strategy Tip

If you have time, have students review and discuss projects from previous years.

3. Distribute the Student Activity, "Peer Review," to each student. The peer reviewers will use this to provide feedback for each student's investigation report. Explain and discuss the vocabulary and meaning of the criteria with your students. Tell students to complete step one by using the questions on the student activity sheet to critique their own work. Discuss the results.

4. Once students have had time to review their own work, distribute another Student Activity, "Peer Review," to each student. Have the peer reviewers write their name at the top of the activity sheet as well as the name of the student investigator. Students should read a peer's investigation and respond to the questions as best as they can. Once students have completed the review it should be handed to another reviewer along with a new student activity sheet.

5. Repeat this procedure so that three peer reviewers critique each investigation. Once this is done, make sure that the investigation reports are returned to the authors.

6. Allow time for the original writers to read the comments and respond to them. This may necessitate some re-writing of the investigation report. In some cases, the original writers may disagree with the comments and not want to include them. This is fine as long as they can justify this in writing. Once students are confident

that their report represents their best efforts, they may turn in the revised investigation report to be used to create a poster.

7. Explain to students that an important aspect of scientific research is communicating findings to the science community. This is often done as a poster presentation. Investigators often must submit a one-page abstract that describes their research and findings before their proposed poster session is accepted. Instruct students to construct a one-page abstract that summarizes their research, and ask them to submit their one-page abstract for approval before beginning their poster.

Alternate Strategy Tip

Provide examples of abstracts that have been submitted to professional meetings. These are often found on conference Web sites.

8. Once their abstract has been approved, ask students to start designing a poster presentation. Provide the space limitations as part of the requirements. You may want to limit the area to a typical science fair backdrop board. Distribute the Student Activity, "Poster Session Rubric," to each student. Review the criteria that will be used to evaluate the posters and presentations. Allow time for students to prepare their posters and presentations.

9. Allow students an opportunity to walk around and evaluate each of the posters using the appropriate sections of the rubric. During the poster presentations, instruct students to use the appropriate sections of the rubric. Allow between 5-10 minutes for each presentation with time for questions and answers from the teacher and students.

TEACHER RESOURCES

http://cpr.molsci.ucla.edu/cpr/cpr_info/
Calibrated Peer Review

http://mwp01.mwp.hawaii.edu/peer_review.htm#what
University of Hawaii, Manoa Writing Program

http://www.bsu.edu/classes/caristi/pp1/
The Importance of Student Peer Review by Dom Caristi

http://www.cyberfair.iskul.org/preview.php
Philippine School Cyber Fair Peer Review